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Integrating, substituting value of b , and reducing,

$$V_2 = \frac{(d-r)[3a^2r^2 - (d-r)^2(2ah-h^2)]}{3r\sqrt{(2ah-h^2)}}$$

$$\left[\pi - 2 \sin^{-1} \left(\frac{r(a-h)}{\sqrt{[a^2r^2 - (d-r)^2(2ah-h^2)]}} \right) \right]$$

$$+ \frac{\pi r^2 h (3a-h)}{3(2a-h)} - \frac{4}{3}(d-r)(a-h)\sqrt{(2dr-d^2)}$$

$$+ \frac{4a^3r^2}{3(2ah-h^2)} \tan^{-1} \left(\frac{(a-h)(d-r)}{a\sqrt{(2rd-d^2)}} \right) - \frac{2r^2(a-h)}{3(2ah-h^2)} (2a^2+2ah-h^2) \sin^{-1} \left(\frac{d-r}{r} \right).$$

If $d=2r$, $V_2 = \frac{2\pi r^2 h (3a-h)}{3(2a-h)}.$

If $d=2r$, $a=h$, $V_2 = \frac{4\pi r^3 h}{3}$. Total volume = $V + V_2$.

Also solved by G. W. GREENWOOD.

162. Proposed by J. E. SANDERS, Hackney, O.

Solve the differential equations

$$(a) \ x \frac{dy}{dx} - y = x\sqrt{(x^2 + y^2)}, \quad (b) \ \cos x \frac{dy}{dx} + y = 1 - \sin x.$$

Solution by G. B. M. ZERRE, A. M., Ph. D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.; E. L. SHERWOOD, Professor of Mathematics, Shady Side Academy, Pittsburg, Pa.; M. E. GRABER, Graduate Student, Heidelberg University, Tiffin, O.; and the PROPOSER.

$$(a) \ xdy - ydx = x[x^2 + y^2]dx. \quad \text{Let } y = vx. \quad \therefore dy = vdx + xdv.$$

$$\therefore dx = \frac{dv}{\sqrt{[1+v^2]}}. \quad \therefore x + A = \log \{v + \sqrt{[1+v^2]}\}.$$

$$\therefore x + A = \log \left(\frac{y + \sqrt{x^2 + y^2}}{x} \right).$$

$$(b) \ \cos x dy + ydx = [1 - \sin x]dx. \quad \text{Let } y = v[1 - \sin x].$$

$$\therefore dy = [1 - \sin x]dv - v \cos x dx. \quad \therefore dx = \cos x dv - v \sin x dx = d[v \cos x].$$

$$\therefore x + A = v \cos x = \frac{y \cos x}{1 - \sin x}. \quad \therefore y \cos x = [x + A][1 - \sin x].$$

Solved in the same way by HOMER R. HIGLEY, LON C. WALKER, and J. SCHEFFER.